

## Collaborative Research Programme Project Definition (1 of 2)



<b>Project Number:</b>	003
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<b>Project Title:</b>	Increasing the Spectral Efficiency of Long-Range Outdoor MIMO Channels by Utilising Relays, Cooperative Base Stations and Similar Techniques.
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<b>Relation to Research Areas:</b>
Distributed networks using advanced wireless techniques such as MIMO.

<b>Background of Project Provider:</b>
This area of research is of significant interest to MiMOMax Wireless Limited (MWL), a new company established within the Tait group of companies specifically to exploit innovative MIMO solutions. MWL is currently deploying a number of ground breaking MIMO solutions in narrow-band channels in the 400MHz band operating over distances from a few kilometres to over 60 km. MWL is keen to see the above techniques applied to increase the capacity of such links and is keen to work closely with researchers on such projects.

<b>Statement of Need:</b>
<p>Research and practical implementations have demonstrated that using Multiple Input-Multiple-Output techniques can provide a substantial increase in spectral efficiency (greater information capacity within a given channel bandwidth). In environments that provide sufficient multi-path scattering the capacity can increase almost linearly with the number of antennae.</p> <p>Mostly large-antenna-number MIMO solutions have been restricted to GHz frequencies and indoor environments where there is substantial multi-path propagation. This results in the channel gain matrix even between large numbers of antennae having close to full rank (ie the paths are largely independent of each other).</p> <p>In a long-range outdoor situation this tends not to be the case. While scattering occurs, the additional multi-path signals tend either to be substantially attenuated or highly correlated with each other, limiting the number of antennae that can be effective.</p> <p>It is believed that these limitations can be mitigated by artificially creating additional propagation paths. This could be achieved by having a number of transmitters and receivers at substantially different locations cooperating to form a base station at each end of the link. Alternatively or additionally other receiver and transmitter pairs could be used to relay the signal in its path from one end of the link to the other, thereby creating an additional path. There are a number of related techniques that could be usefully embodied in such a solution including Transmitter and receiver diversity, space-time coding and multi-user detection (MUD).</p> <p>This is a very broad research topic that could result in a number of individual research projects.</p> <p>Applicants are requested to put forward project proposals, which can overcome the technical problems detailed in the above description.</p>

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### Potential for Follow On Work:

Dependant on the outcomes of the research, there is the potential of follow on work to build on the findings the research undertaken in this project or to investigate related other related areas.

### Anticipated Duration:

The anticipated period for undertaking this project is 12 months, although the industry partner expects continuous engagement with the researchers, in order to make use of findings as early as possible and to transfer knowledge in the subject area to their staff and the WRC.

### Project Budget:

\$75,000

(This is a nominal figure, the actually funding provided will be finalised once the project has been fully scoped.)

### For further information Contact:

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### Appendices

**Schedule A – Non-Disclosure Agreement**

**Schedule B – Intellectual Property Agreement**